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REPLACEMENT DRAWINGS - FOR ENTRY

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REMARKS

The Examiner is thanked for noting the inconsistencies in the drawings. Figure 2a has been amended to address the drawing objection regarding the “collimating optics.” In particular, as the “collimating optics” may be part of the laser light source, the source 202 in Figure 2a has been slightly modified to include a portion 204 which, as now described in paragraph [0022], represents the “collimating optics 204.”

The Examiner also objected to Figure 2a, as the written description for that figure did not provide a description for the designation “R,” which as described in the specification at paragraph [0041] (page 11) is a “triangulation axis.” To address this informality, the text of paragraph [0041] has been amended to also reference back to Figure 2a. Thus, the portion of the original figure relating to the triangulation axis R is now consistent with the specification. The drawings should now be in compliance with all formal requirements.

The objection to the specification has been corrected by changing the reference numeral in [0029] (page 7) from 232 to “222.” The written description should now be in compliance with all formal requirements.

The claim objections were well taken and have been addressed as follows. Claim 8 has been amended to correct its dependency, to claim 1. The objection regarding claims 13-15 is moot, as these claims (which included several “means plus function” or “MPF” clauses) have been cancelled.¹ The original objection to claim 18 is moot, as the structure (“the lens”) has been omitted; that structure was superfluous in any case given that this is a method claim. While there were no other formal patent claim objections, during the process of preparing for the Interview new counsel of record made a thorough review of the pending claim language and identified several other wording issues in the claims. Accordingly, several additional revisions

¹ These claims were not cancelled due to the objection or because of the prior art, however. In this regard, the Examiner noted at the conclusion of the Interview that he had not formed a firm opinion regarding whether the cited prior art (Wenz, in particular) was still applicable to the MPF clauses, given the arguments that were made during the presentation. (Claims 13-16, which included the MPF clauses, were not specifically discussed at the Interview). Nevertheless, in reviewing these claims following the Interview, it was determined that the MPF-style claims were superfluous. Thus, as in the companion case 10/804,694, and to reduce the number of outstanding issues, these claims now have been cancelled. For the reasons advanced during the Interview, however, these claims were neither anticipated nor obvious in view of Wenz, taken either alone or in combination with any other of the cited art. In this regard, it should be noted that an MPF clause can only be met if both identical function and corresponding (or equivalent) structure can be shown in the cited reference. Wenz does not have any structure corresponding to at least the “means for generating a collimated laser beam of light” or the “scanner means for generating” in independent claim 13 as originally filed.

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have been made to the claim language either to correct defects in the original wording, to improve readability, or both; see, e.g., dependent claims 6 and 9. The claims are now deemed to fully comply with 35 U.S.C. §112.

Claims 1-2, 9, 11 and 13-15 were rejected under 35 U.S.C. §102(b) as being anticipated by Wenz, U.S. Patent No. 5,440,393. Claim 3 was rejected under 35 U.S.C. §103(a) as being unpatentable over Wenz, in view of Galbraith, U.S. Patent No. 5,168,386. Galbraith is cited merely for its teaching of a "telecentric scanner" having a "flat field scan lens." Claim 4 was rejected under 35 U.S.C. §103(a) as being unpatentable over Wenz, in view of Galbraith, U.S. Patent No. 5,168,386, further in view of Choate, U.S. Patent No. 5,832,107, and Ernst, U.S. Patent No. 6,402,707. Choate was cited for his teaching of "stereoscopic system telecentric lens." Claim 5 was rejected as obvious in view of Wenz, Galbraith, Choate, Ernst and Ozeki et al., U.S. Patent No. 5,280,542. Ozeki et al. were cited to show deriving 3-D coordinates by merging vertical and horizontal image data. Claims 6 and 8 were rejected as obvious in view of Wenz, Galbraith, Choate, Ernst and Mushabac, U.S. Patent No. 5,545,039. Mushabac was cited for its teaching of an object positioning system. Claim 7 was considered to be obvious over the combination of Wenz, Galbraith, Choate, Ernst, Mushabac and Ozeki et al. Claim 10 was considered obvious in view of Wenz, and Claims 12, 16-18 and 20 were considered obvious in view of the combination of Wenz and Ernst. As discussed during the interview, respectfully each of these rejections is traversed, as neither Wenz nor Ernst disclose certain subject matter, as is now described.

With respect to the anticipation rejection of claims 1-2, 9, 11 and 13-15, MPEP § 2131 provides that a "claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described in a single prior art reference. ... 'The identical invention must be shown in as complete detail as contained in the ... claim.' The elements must be arranged as required by the claim." (citations omitted, emphasis supplied).

Wenz does not meet this stringent requirement. The patent describes an interferometer system, not a beam deflection system. The background portion of this application identifies the interferometer approach (such as described and illustrated in Wenz) as the prior art. It was demonstrated during the Interview that Wenz has no collimating optics, and no scanner to scan a collimated beam pattern along at least two axes. Indeed, the word "collimating" is not used in Wenz. The collimating optics are useful in the laser digitizer of the subject application to ensure

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that a tightly-focused spot can be transmitted over the optical path; Wenz, in contrast, needs to create a wide beam just to generate the required interference pattern within the device itself. Moreover, Wenz teaches away from using collimation, indicating at Column 9, line 55+ that the beam generated by his device has the characteristic that the "whole of the buccal cavity can be illuminated simultaneously (emphasis supplied)." As the Examiner indicated in the Interview Summary, there is no "light source having collimating optics" configured to generate a collimated beam of light in Wenz. For this reason alone, Wenz did not anticipate any of claims 1-2, 9, 11 and 13-15 as originally filed.

As to the scanner limitation, as also discussed during the Interview, an interferometer does not scan a beam of light; Wenz uses mirrors 12 and 14 to cause two beams of light to interfere with each other to create a single interference pattern. Wenz then uses a sinusoidal mirror to cause incident light to be reflected along different paths. As further demonstrated to the Examiner, the Wenz interferometer approach is not dynamic scanning of a single collimated beam along at least two axes. Indeed, Wenz states explicitly that his "strip pattern ... is generated by means of interference (Column 11, lines 20-21)," which is not scanning, as the original claim language recited. For this additional reason, Wenz did not anticipate any of claims 1-2, 9, 11 and 13-15 as originally filed.

As noted above, there were several additional claims that were deemed to be unpatentable over the combination of Wenz in view of Ernst (and/or certain other references). For the reasons discussed during the Interview, any obviousness rejection based on Wenz, or Wenz and Ernst, is also respectfully traversed.

In particular, although Ernst relates generally to intra-oral imaging, the patent deals specifically with the problem of processing multiple scans or views that have been generated by some device. The patent, however, assumes a number of three dimensional data sets (from the individual scans) exist, but it does not prescribe any particular structure or process for generating a particular data set, which is the subject of this invention. The Examiner relied upon the reference to the extent it taught the use of a "global coordinate space" associated with the oral cavity; this space, according to the patent, could be mapped by "any global coordinate system" including a "curvilinear coordinate system (emphasis supplied)." As discussed during the Interview, however, the reference to "curvilinear" in the patent was used only in the context of a "curvilinear coordinate system." There was no disclosure or suggestion to generate a particular

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data set, e.g., by directing a pattern of a plurality of segments (e.g., curves) onto a physical object, or how to do so. Because this subject matter was not present in Ernst, any permissible combination of Wenz and Ernst could not have been the subject matter, taken as a whole, of any of the claims as originally filed.

Although each art rejection has been traversed, during the Interview preparation it was determined that some of the claims could be amended to clarify the nature of the present invention. As can be seen from the arguments set forth above, these amendments have not been made to address prior art rejections. Thus, as discussed during the Interview, claim 1 has been amended to clarify that, in effect, the scanner is generating "a pattern comprising a set of curvilinear segments" that is projected onto the object, and that it is a reflection of the pattern that is processed to generate an image of the object. This operation was demonstrated to the Examiners during the Interview. In particular, as the "light source" generates "a collimated beam of light" and the scanner scans this beam over a time interval (e.g., the reciprocal of the frame rate, or the shutter speed), an image sensor in the image capture instrument, in effect, "sees" a pattern (e.g., a set of segments). Thus, the phrase "to generate a pattern" has been added in amended claim 1 to help clarify this point.

Method claim 17 also has been amended to clarify that the "representation" is created from data that is generated by carrying out the pattern scanning and reflection with respect to the object as the object is positioned in first and second positions (relative to the beam) during respective first and second exposure periods. In other words, the object is positioned (relative to the beam) and the pattern scanning and reflection is carried out during a first exposure period. The object is then re-positioned (relative to the beam) and the pattern scanning and reflection is carried out during a second exposure period. The prior art does not describe or suggest these set of steps.

New independent claim 21 has been included to describe the "two pass" (first and second exposure) operation in the context of a laser digitizer having a structure in which the object to be imaged is supported (see, e.g., Figure 6), as well as the light source having collimating optics and the associated scanner. This claim is patentable over Wenz, or Wenz and Ernst, for the reasons previously advanced. In particular, neither Wenz nor Ernst discloses or suggests at least the following claim elements:

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“a scanner optically coupled to the light source and configured to scan the collimated beam along at least two axes towards the object to be imaged, wherein over a given exposure period the scanned collimated beam of light generates a pattern comprising a plurality of segments, wherein the structure is positionable relative to the scanned collimated beam so that, during first and second exposure periods, first and second patterns are projected onto first and second portions of the object;

an image capture instrument configured to detect a reflection of the scanned collimated beam from the object at a given triangulation angle θ , wherein over the first exposure period the reflection comprises a modified first pattern and over the second exposure period the reflection comprises a modified second pattern; and

a processor, under program control, that uses data associated with the modified first and second patterns to generate a representation of the object.”

Claim 22 further limits the laser digitizer as described in claim 21 by requiring that each segment is a curve.

As discussed during the Interview, the primary references applied against the claims were Wenz and Ernst, and these references do not disclose or suggest the inventions now positively recited in each independent claim. As noted above, the office action included several secondary references. In particular, Galbraith was cited for a teaching of a “flat field scan lens.” Choate was cited for teaching a “telecentric lens.” Ozeki et al. were cited to show deriving 3-D coordinates by merging vertical and horizontal image data, and Mushabac was cited for its teaching of an object positioning system. The secondary references, however, describe features that are no longer claimed; more to the point, these teachings do not make up for the deficiencies in the primary references and, thus, any permissible combination of Wenz (or Wenz and Ernst) and any such secondary reference does not make out a prima facie case of obviousness of any independent claim, taken as a whole.

For the reasons advanced during the Interview and herein, each of independent claims 1, 17 and 21 are now deemed to describe patentable subject matter. The remaining claims are dependent, and each such claim is allowable for at least the reasons advanced with respect to its respective parent claim.

A Form PTO/SB/82 has been included to appoint the undersigned as counsel of record. Please note the Change of Correspondence address.

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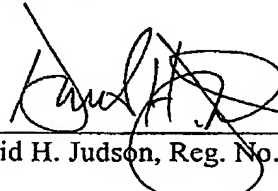
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Once again, the undersigned would like to thank Examiner Stock for his time during the recent Interview, and for his further consideration of the claims and the above remarks.

A Notice of Allowance is respectfully requested.

Respectfully submitted,

By:


David H. Judson, Reg. No. 30,467

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ORIGINAL DRAWINGS – ANNOTATED TO SHOW CHANGES

Patent Application: For LASER DIGITIZER SYSTEM FOR DENTAL APPLICATIONS

Inventor: Henley Quadling *et al.*

Our Ref. No.: 12075/20

Figure 2a
Top View

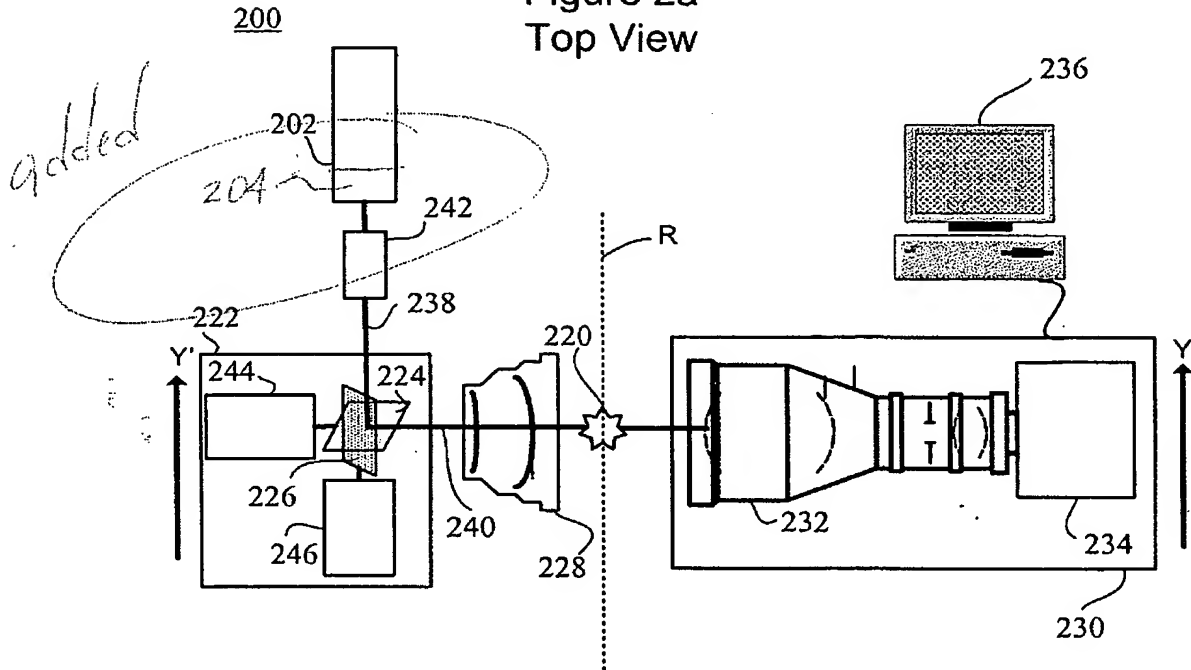


Figure 2b
Front View

